

Mapping the Wildland Urban Interface and Projecting its Growth to 2030

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Problem statement

- The Wildland Urban Interface (WUI) is where wildland fire directly affects millions of Americans
- Wildland fires in the WUI pose a serious management challenge
- ***Relatively little is known about the location of the WUI and its growth and change over time across the U.S.***



Here are some examples of the WUI from across the country.

Clockwise from upper left: Missouri Ozarks; Port Charlotte, FL; Oakland Hills, CA (center); Ruidoso, NM; northern Minnesota; Bend, OR.

Related Research

- Coarse scale map of WUI developed for U.S. as part of a suite of fire risk maps
- Many statewide and regional risk assessments map the WUI:
 - ◆ Florida
 - ◆ Southern Colorado
- Analysis of housing density change over time and its relation to natural resources

Coarse-scale national WUI map: Hardy, C. C., K. M. Schmidt, J. P. Menakis, and R. N. Sampson. 2001. Spatial data for national fire planning and fuel management. *International Journal of Wildland Fire* 10:353-372.

Florida map: Brenner, J., Green, K., Coen, J., and McLellan, S. 2001. Assessing fire risk in Florida using integrated GIS and remote sensing applications. Accessed 4/9/2003 at <http://gis.esri.com/library/unserconf/proc01/professional/papers/pap826/p826.htm>.

Colorado Map: Hann, Wendel.J., Strohm, Diane J. 2003. Fire regime condition class and associated data for fire and fuels planning: methods and applications. Available at <http://fire.org/frcc/HannStrohm2003FrccPaper.pdf>

Housing density analysis: Radeloff, V. C., R. B. Hammer, P. R. Voss, A. E. Hagen, D. R. Field, and D. J. Mladenoff. 2001. Human demographic trends and landscape level forest management in the northwest Wisconsin Pine Barrens. **Forest Science** 47:229-241.

Why locate the WUI?

- Fire risk reduction often targeted on communities or lands within the WUI:
 - ◆ "Priorities [for fuels treatment] are first within the wildland-urban interface" National Fire Plan Interagency Memorandum of Understanding for Development of a Collaborative Fuels Treatment Program.
 - ◆ "Oregon SB 360 will apply to lands classified as 'forestland-urban interface'..."
- A WUI map is a valuable tool for state and national strategic planning

National Fire Plan Memorandum of Understanding for Development of a Collaborative Fuels Treatment Program, Talking Points is available on the web at www.fireplan.gov

Oregon Department of Forestry SB 360 Fact Sheet, available at <http://159.121.125.11/FIREPROT.HTM>

Research Goal

Map, analyze, and summarize the size and extent of the wildland-urban interface across the lower 48 states for the period 1940-2030

We are currently in the second year of work on this five year research effort.

The WUI Definition

- ...where structures and other human development meet or intermingle with undeveloped wildland
 - ◆ **Interface** WUI is where housing meets vegetation
 - ◆ **Intermix** WUI is where housing and vegetation intermingle

This definition, used in the Federal Register, is explained in more detail in: Teie, W.C. and B.F. Weatherford, Fire in the west: The wildland/urban interface fire problem. Report to the Council of Western State Foresters. Rescue, CA: Deer Valley Press.

The WUI Definition

- **Interface** areas
 - ◆ Have more than 1 house per 40 acres,
 - ◆ have less than 50% vegetation, and
 - ◆ are within 1.5 miles of an area >1,325 acres that is more than 75% vegetated

Buffer distance of 1.5 miles adopted from the California Dept. of Forestry and Fire Protection. 1995. Fire management for California ecosystems. California Department of Forestry and Fire Protection, Sacramento, CA.

The WUI Definition

- **Intermix** areas
 - ◆ have more than 1 house per 40 acres, and
 - ◆ have more than 50% vegetation
- **Intermix + Interface = WUI**
- Based on Federal Register definition

USDI and USDA. 2000. Urban wildland interface communities within vicinity of federal lands that are at high risk from wildfire. **Federal Register 66:751-777.**

Mapping the WUI

- Mapping units are US Census blocks
- Housing data from 2000 US Census
- Vegetation data from 1992/93 USGS National Land Cover Data (30 m resolution)
 - ◆ WUI includes forests, shrub, grasslands, wetlands and transitional
 - ◆ WUI *excludes* agriculture and orchards

U. S. Census Bureau. 2000. TIGER/Line Files Technical Documentation. U.S. Census Bureau, Washington, D.C. Data from SF3.

Vogelmann, J. E., S. M. Howard, L. Yang, C. R. Larson, B. K. Wylie, and N. van Driel. 2001. Completion of the 1990s National Land Cover Data Set for the conterminous United States from Landsat Thematic Mapper data and ancillary data sources.

Photogrammetric Engineering & Remote Sensing 67:650-662.

Mapping the WUI

- Our maps include *all* WUI area
 - ◆ *Some WUI is prone to fire, some is not*
- Our data is easily integrated in a GIS platform with data on fuels, ignitions and potential fire spread
- We can identify and characterize communities in the interface

The list of communities we create will include all WUI communities, not just those located in the vicinity of Federal lands.



2000 US WUI Analysis

National Summary Statistics

- ◆ WUI area across the U.S.
 - ☞ 9.3% of land area is WUI
 - ☞ 174,701,260 acres
- ◆ WUI homes across the U.S.
 - ☞ 36.2% of homes are in the WUI
 - ☞ 41,787,289 homes

Preliminary Data

2000 US WUI Analysis

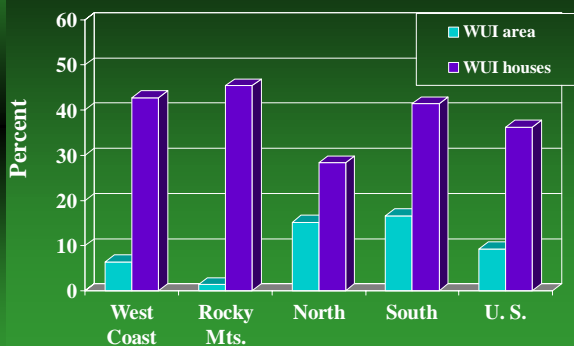
National Summary Statistics

- ◆ Of the total WUI area
 - ☞ 82.1% is intermix
 - ☞ 17.9% is interface
- ◆ Of the *houses* in the WUI
 - ☞ 49.4% are in the intermix
 - ☞ 50.6% in the interface

Preliminary Data

2000 US WUI Analysis

Regional Summary



West Coast: CA, OR, WA.

Rocky Mountain: AZ, CO, ID, MT, NM, NV, UT, WY, KS, ND, NE, SD.

North: CT, DE, IA, IL, IN, WI MA, MI, MD, ME, MN, MO, NH, NJ, NY, OH, PA, RI, VT, WV.

South: AL, AR, DC, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA. U.S.:

All states except HI and AK.

2000 US WUI Analysis

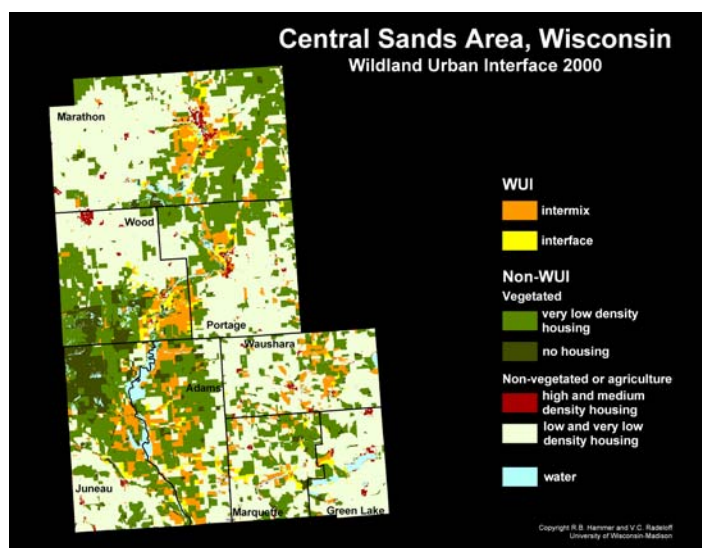
State Highlights

- ◆ Most WUI area
 - North Carolina, 12,761,460 acres
- ◆ Highest proportion of area in WUI
 - Connecticut, 72.4 %
- ◆ Most WUI houses
 - California, 5,087,800
- ◆ Highest proportion of houses in WUI
 - New Hampshire, 81.8 %

Preliminary Data



For state and regional maps, we use separate colors for the interface and intermix.



WUI Dynamics

- The WUI changes over time as housing and vegetation change.
- WUI areas could:
 - ◆ Expand
 - ◆ Contract
 - ◆ Change location
 - ◆ Change pattern

A First Look at WUI Dynamics

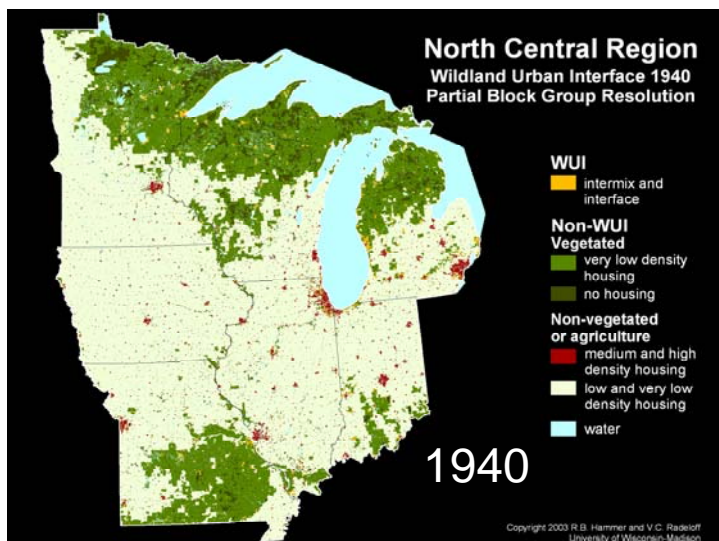
- 1940-1990 WUI maps are based on our reconstruction of fine-scale historic housing density
- Initial housing projections through 2030 are based on 1990 housing growth rate
 - ◆ 1992-93 landcover data used throughout the series
 - ◆ 1990 growth rate was higher than 1980, lower than 1970.

For details about our housing density backcasts and the methods we use, see our slide show at:

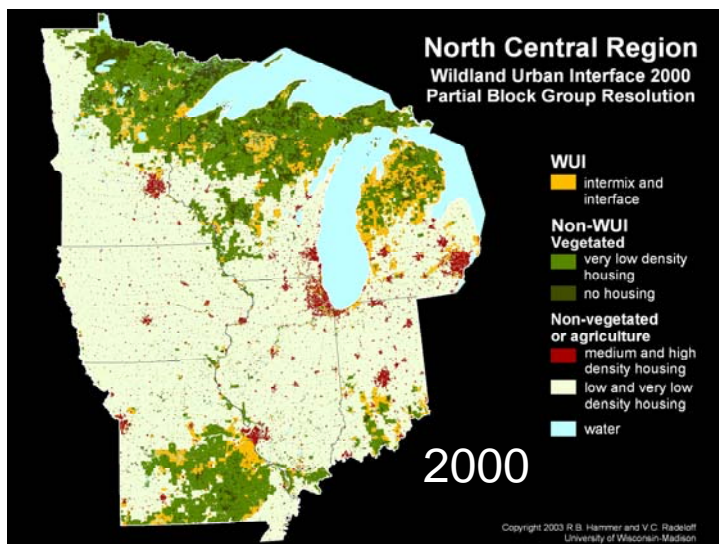
<http://www.ncrs.fs.fed.us/IntegratedPrograms/lc/pop/hd/title.htm>

For more about rural growth, amenity migration, and changing settlement patterns, see University of Loyola-Chicago demographer Ken Johnson's web page at:

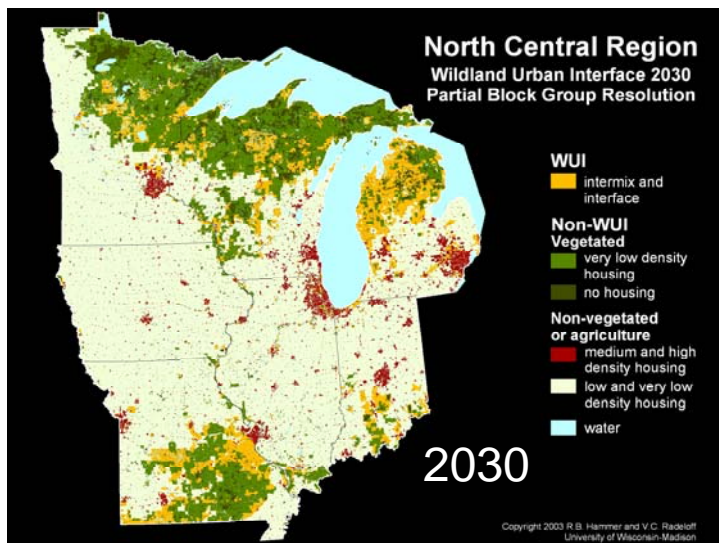
<http://www.luc.edu/depts/sociology/johnson/research.html>.



This map shows 1940 WUI at the partial block group level. The landcover map of 1992-1993 is used here (and throughout this map series) as an approximation of 1940 landcover. In this region, the 1940 was less heavily forested than it is now. Consequently the use of 1992-1993 landcover may overestimate historic WUI.



This map shows the current location and size of the WUI.



This preliminary projection of the WUI's size and location indicates that, if current trends in housing growth continue, the WUI will increase substantially over the coming decades.

Future Products

- Final version of US WUI map (6/03)
- Summary statistics for states, counties and communities (6/03)
 - ◆ Area (acres)
 - ◆ Number of homes
- List of WUI communities by state (6/03)
- Social characteristics of WUI communities (6/04)

Conclusions

Our US WUI maps are:

- ◆ Scientifically based and consistent
- ◆ National in scope
- ◆ Fine scale
- ◆ Dynamic
- ◆ Easily integrated with other fire management and fire science projects

Summary

- The WUI is widespread
- WUI area is mostly intermix
- WUI housing units are equally split between intermix and interface
- The WUI is growing fast